Savannah and Woodland Management of Shortleaf Pine

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Savannahs are typically thought of as transitional landscapes between forest and prairie (Fig. 1), containing a sparse overstory and well-developed herbaceous understory, including grasses, wildflowers, and occasional understory shrubs.

A similar concept is a woodland, which is a transitional landscape between savannahs and forests (Fig. 2). In woodlands, overstory density is typically greater and understories are not as well-developed and may contain more woody plants than what is typical of savannahs.

The open-forest canopy and rich understory vegetation of both communities were historically maintained by frequent, low-intensity fires. Although savannahs and woodlands were once widely distributed across much of the eastern U.S., they are now rare due to fire exclusion, land clearing, and natural succession. Many plant and animal species associated with forests, forest edges, and open prairies thrive in these communities making savannahs and woodlands some of the richest and most diverse natural communities in the region.They provide excellent habitat for northern bobwhite quail, eastern wild turkeys, and in many cases, white-tailed deer.

Figure 1: Shortleaf pine savannah in Oklahoma. Credit: Clarence Coffey

Site Selection

Savannah restoration will be more successful on the right site. Presence of "relict" plants are indicators of previous savannah sites. These include large tree crowns (indicating they were grown with more sunlight in an open landscape), dominance of fire-tolerant species in the overstory (example: longleaf and shortleaf pines, and bur, post, and white oaks), and presence of grasses in the understory (example: bluestem, indian grass). Studies suggest that savannahs and woodlands were found on drier sites, ridgetops, and south or west facing slopes where frequent fire occurred.

When evaluating a site for savannah or woodland restoration, ease of timber harvest and prescribed fire potential are two essential site selection criteria. Equipment accessibility and adequate timber stocking is important to make management activities practical and attract timber buyers. Location, stand configuration, and topography of the site must be considered in regards to prescribed fire. Stands with steep slopes, irregular boundaries, or are located near roads, houses, or schools are conditions that may limit the ability to conduct a prescribed burn. Lastly, while smaller areas can be restored, larger sites are more practical due to economy of scale and the noted adaptation success of certain plant and animal species to larger sites.

Figure 2: Shortleaf pine woodland in the Ouachita National Forest. Credit: Clarence Coffey

Canopy Management

After selecting a site, the first restoration step is to thin the number of trees per acre, or basal area, to the desired target number. Basal area is used to describe the average amount of an area (usually an acre) occupied by tree stems, typically expressed as square feet per acre. Although there are no exact criteria for savannahs and woodlands, suggested basal area targets for savannahs are between 30–45 ft2/ac. and for woodlands between 45–65 ft^2/ac. Basal area range should be modified depending on stem diameter and crown size. Stands with numerous large diameter trees or large crowns should be thinned to the lower end of the basal range. Conversely, stands with many small diameter trees should be thinned to the higher end of basal area range. Thinning to a higher initial basal area may be beneficial to offset loss of trees from wind, insects, disease, or fire damage.

Leave trees, or the trees remaining after thinning, should be vigorous, large canopied trees of fire-tolerant species. It is recommended to retain fire-tolerant white and red oak types, hickories, and black gum. Fire-intolerant species, such as maple, yellow poplar, and white and Virginia pines are likely to be damaged by prescribed fire and are recommended for removal.

Fire Management

Prescribed fire is essential for restoring and maintaining the savannah or woodland landscape. Following thinning, especially where hardwood roots are well established, woody vegetation will regrow vigorously with the increased sunlight created by thinning the canopy (Fig. 3). If this hardwood vegetation is not suppressed with fire, it will dominate the understory within 3–5 years, depending on site quality. Therefore, it is critical to begin burning 2–3 years after thinning the site, a sufficient time frame where sprouts and woody seedlings grow large enough to be vulnerable to fire. Waiting 2–3 years also enables a small duff layer, or fine fuels, to accumulate on the forest floor and fuel a low temperature fire. Initially, leaf litter will be the primary source of fine fuels, but over time, fire-adapted grasses will become established and contribute to the fine fuel bed.

Growing-season fires are highly effective at killing hardwood roots and other understory woody vegetation and should be used when possible. Fire intensity should be low enough not to damage overstory trees but intense enough to be effective in suppressing sprouts. Flame lengths of 2–3 feet with moderate rates of spread (burning less than 5 feet/ minute) are desirable. In areas that receive greater than 40 inches of annual rainfall, prescribed fire, or fire return intervals, should be every 2 years. On drier sites receiving less than 40 inches of rainfall a year, fire return interval is every 2–3 years. Less frequent intervals will result in hardwood overgrowth, which will dominate the ground layer and become difficult to control. In the early stages of restoration, this is especially critical since many hardwood sprouts are supported by large, well-established roots. Dormant-season fires may also be used, especially when weather conditions prevent growing-season burns. Ultimately, prescribed fire is critical for successful savannah and woodland restoration.

Figure 2: Understory hardwood vegetation in the Ouachita National Forest, Arkansas. Credit: Clarence Coffey

Herbicide as an Alternative to Fire

Although herbicides are not a satisfactory replacement for fire, they play an important role in restoration. Trees that are greater than 3 inches in diameter at breast height (DBH), are not likely to be controlled by fire. These trees can be treated with herbicides by several manual application methods including basal bark spray, stem injection, and cut stump. Directed foliar spray can be used on sprouts that persist following fire. Although they are labor intensive, manual herbicide treatments provide landowners a safe and effective way to control unwanted hardwoods with minimal equipment.

When selecting herbicides, consideration must be given to the residual soil activity of the herbicide and its potential damage to overstory trees. This is especially critical on sites where oaks or other hardwoods comprise a substantial percentage of the overstory.

Full development of a savannah or woodland will take many years to complete. Forest managers must adapt to changing circumstances and conditions and be prepared to adjust the timing and application of fire, herbicides, or other treatments. A mixture of both growing- and dormant-season fires will, over time, maximize plant diversity within the understory plants. In the long term, if regeneration of some overstory trees is needed and adequate reproduction of desirable species is not present, modifications to fire regimes (longer fire return intervals) may be necessary over a portion of the restoration site to allow for natural regeneration of the trees to occur. Experience has demonstrated that sprouts of fire-tolerant oaks and pines can be quite resilient even with a 2-year fire return interval. Keeping these suppressed may prove to be a greater challenge than providing adequate regeneration.

References

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